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1           TITLE: CARTON LOADING AND CLOSING MACHINE

2   Field of the Invention:

3           This invention relates to carton loading and closing  
4 machines.

5   Background of the Invention:

6           Machines for the automatic and semi-automatic loading  
7 and closing of cartons are widely used in a number of  
8 different forms. The most widely used machines may be  
9 divided into three categories: a) manual carton-over-  
10 product machines, b) top loading machines involving either  
11 manual loading or loading by means of drop or place packers  
12 and c) bottom loading machines.

13          It is self evident that the avoidance of any manual  
14 loading operation is desirable since the labour component is  
15 becoming increasingly expensive and the speed of operation  
16 of the machine has an inherent operator dependent speed  
17 limitation. By the same token, the capital cost of the  
18 machine is an important factor. With the exception of drop  
19 or place packers, which are expensive, most known automatic  
20 machines are limited by the number of cartons which can be  
21 loaded and closed in a predetermined time. At present, such  
22 lower cost machines are limited to practically achievable  
23 speeds of the order of ten to twelve cartons per minute,  
24 which are approximately the speeds which can be achieved by  
25 a very skilled operator.

26          Automated bottom loading machines are considered to be  
27 the most cost effective means of loading since they do not  
28 require the cost of a special loading robot of the type  
29 needed for a top loading machine, and they have the  
30 advantage of providing positive location of the carton at  
31 the position in which the products to be packaged are loaded  
32 into the carton. Although the reason is not particularly  
33 apparent, carton-over-product loading machines require  
34 either a skilled operator or a complex mechanism to ensure  
35 that the carton properly engages the array of products to be  
36 packaged during each loading operation.

37          The attractiveness of bottom loading machines has to  
38 date been limited by their restricted speeds of operation

1 and the major restrictions on the speed of operation would  
2 appear to be due primarily to the mechanism for initially  
3 opening the folded carton and for moving it to the loading  
4 position, and the mechanism for closing the bottom of the  
5 carton after the product has been loaded.

6 In the case of one known bottom loading machine, the  
7 speed of operation of the carton opening mechanism is  
8 restricted by the positioning of the carton manipulating arm  
9 at the leading part of the carton so that the mechanism must  
10 be withdrawn over the carton before any loading operation  
11 may take place. In the case of the bottom flap closing  
12 operation, the speed of one known mechanism is severely  
13 restricted by the requirement that one end flap is first  
14 closed by forward movement of the loaded carton through a  
15 standard closing plough followed by rotation of the carton  
16 to locate the other flap in a closing slot following which  
17 the flap is closed by further forward movement through a  
18 closing plough. The above factors cause a significant  
19 slowing of the loading and closing operation and also serve  
20 to complicate the mechanisms which are used in the machine.

21 In addition to the above, most known machines are  
22 restricted by the complexity of the operations necessary for  
23 converting the machine for the loading of cartons of  
24 different sizes. In most cases, the conversion operation is  
25 so complex that it is more practical to restrict each  
26 machine to the loading and closing of a particular size of  
27 carton. This is clearly not economic both in terms of  
28 capital cost and efficiency of use of equipment and factory  
29 space.

30 Summary of Invention and Objects:

31 It is the object of the present invention to provide an  
32 improved carton loading and closing machine in which the  
33 above deficiencies of the prior art are at least  
34 ameliorated.

35 Accordingly, the invention provides a carton loading  
36 and closing machine comprising means for locating an open  
37 carton in a first predetermined position, means for loading  
38 said carton through the open bottom flaps of said carton at

1 said first predetermined position, means for moving said  
2 carton forwardly to a second predetermined position over  
3 means for folding the leading end flap of said carton to the  
4 closed position under said packaged products, second flap  
5 folding means mounted for movement transversely of said  
6 carton at said second predetermined position to fold said  
7 trailing end flap against said packaged products, said  
8 second flap folding means including an upper surface  
9 defining an opening for receiving said trailing flap and  
10 means for causing said trailing flap to be folded to the  
11 closed position as said second flap folding means is moved  
12 transversely with respect to said carton.

13 In another aspect, the invention provides a method of  
14 loading and closing a carton comprising the steps of  
15 locating an open carton in a first predetermined position  
16 with the lowermost flaps of said carton open, loading the  
17 products to be packaged into said carton through said open  
18 bottom flaps at said first predetermined position, moving  
19 said carton forwardly to a second predetermined position and  
20 folding the leading end flap of said carton to its closed  
21 position under the packaged products during said forward  
22 movement, and closing the trailing end flap of said carton  
23 to its closed position under said packaged products while  
24 said carton is held stationary at said second predetermined  
25 position.

26 It will be appreciated from the above that the carton  
27 loading and closing machine and method defined produce a  
28 partly closed carton with only one forward movement of the  
29 carton, with no rotary movement of the carton being  
30 required. Since both the first and second predetermined  
31 positions of the carton may be accurately defined, the  
32 carton may be indexed to such positions quite rapidly and  
33 since the trailing end flap is closed by movement of a  
34 closing means rather than by movement of the carton, this  
35 operation may also be achieved more rapidly than in the case  
36 of prior art machines, using otherwise "dead time" of the  
37 machine. While no mention is made in the above definitions  
38 of the closing of the side flaps or the top flaps of the

1 carton, this operation may be achieved in a straightforward  
2 manner by existing carton closing techniques which need not  
3 be further defined in the present specification.

4 A further advantage of the defined machine and method  
5 is that the indexing positions of the first and second  
6 predetermined positions are defined by the rear face of the  
7 carton and accordingly the size of the carton being loaded  
8 and closed does not affect either the nature of the carton  
9 opening mechanism which presents the carton to the first  
10 predetermined position, and which is described in greater  
11 detail below, or the means for closing the trailing end flap  
12 which is located at the trailing edge of the carton in the  
13 second predetermined position. These factors result in  
14 significant simplification of the changes which are required  
15 to accommodate cartons of different size.

16 The machine defined above is associated with a carton  
17 opening mechanism which presents the carton in the open  
18 state at the first predetermined position. While a  
19 preferred carton opening mechanism will be described below,  
20 it should be appreciated that the machine as defined above  
21 may be used with varying degrees of efficiency with any  
22 carton opening mechanism. However, for maximum efficiency,  
23 the carton opening mechanism to be defined below is  
24 preferred.

25 The preferred carton opening mechanism preferably  
26 comprises means for holding a multiplicity of folded  
27 cartons, means for lifting a carton from said multiplicity  
28 by one end panel of said carton, means for moving the carton  
29 from its initial position to an intermediate position  
30 adjacent said first predetermined position and for rotating  
31 the carton through 180° during said movement so that the  
32 said lifting means is located at the rearmost end panel of  
33 the carton, and fixed rail means located to one side of said  
34 intermediate position and against which a leading corner of  
35 said carton engages whereby part of said rotary movement of  
36 said carton causes the carton to be fully opened when  
37 located at said intermediate position, and means for  
38 indexing said carton from said intermediate position to said

1 first predetermined position with the side flaps of said  
2 carton extending laterally to either side of the carton and  
3 said end flaps extending downwardly from said carton.

4 The principle advantages of the above arrangement are:

5 (a) As a result of the partial rotation of the carton  
6 from the pickup point to the intermediate position results  
7 in the means for lifting the carton from the multiplicity of  
8 cartons being located at the rearmost panel of the carton  
9 when erected, thereby enabling the lifting means to retract  
10 directly to the pickup position without in any way  
11 inhibiting the progress of the carton to the next position.

12 (b) The use of a fixed rail against which the carton  
13 engages to cause its opening or erection enables the  
14 mechanism to be used for different sized cartons without  
15 significant adjustments to the mechanism.

16 The mechanism preferably includes a fixed finger which  
17 temporarily engages the trailing walls of the carton during  
18 the initial pickup operation to "break" the carton to a  
19 slightly open position whereby the carton is less resistant  
20 to the subsequent opening operation on engagement with the  
21 fixed rail.

22 It will be appreciated that when the above mechanism is  
23 used in combination with the carton loading and closing  
24 machine defined above, the efficiencies of operation of the  
25 loading and closing machine are able to be maximized due to  
26 the ability of the mechanism to operate at relatively high  
27 speeds. In a preferred form of the above defined mechanism,  
28 the means for lifting cartons from the multiplicity of  
29 cartons comprises an arm carrying a vertically oriented pair  
30 of suction cups of known form which adhere to the surface of  
31 the carton end wall to lift a carton from a magazine  
32 carrying said multiplicity of cartons. In a particularly  
33 preferred arrangement, the suction cups are positioned so as  
34 to engage one end wall of the carton at a position adjacent  
35 the crease line between that end wall and the exposed side  
36 wall of the carton. This "off-centre" pickup point assists  
37 in initially opening the carton as the mechanism rotates  
38 from its initial pickup position to the intermediate

1 position where the leading corner of the carton first  
2 engages the fixed rail.

3 The mechanism by which the above carton pickup and  
4 erection is achieved is not important to the invention and  
5 may comprise a combination of cams and tracks and chain  
6 drives or any other acceptable mechanical mechanism for  
7 causing the necessary motions.

8 Brief Description of the Drawings:

9 One preferred form of the present invention will now be  
10 described with reference to the accompanying drawings in  
11 which:

12 Figure 1 is a perspective view of a carton erecting,  
13 loading and closing machine embodying the invention;

14 Figure 2 is a plan view of the machine shown in Fig. 1;

15 Figure 3 is a sectional elevation of the loading and  
16 flap closing section of the machine taken along the line 3-3  
17 in Fig. 2;

18 Figures 4a, b, c to 7a, b, c are sectional plan views  
19 taken along the line 4-4 in Fig. 3 and along the lines b-b  
20 and c-c respectively of Figs. 4 to 7;

21 Figure 8 is a plan view of a modified bottom end flap  
22 closing mechanism;

23 Figure 9 is a sectional elevation of the mechanism of  
24 Fig. 8 taken along the line 9-9;

25 Figure 10 is a plan view of a further modified bottom  
26 end flap closing mechanism, and

27 Figure 11 is a front elevation of the carton pickup and  
28 erecting mechanism shown in Figs. 1 and 2, and taken along  
29 the line 11-11 in Fig. 2.

30 Description of Preferred Embodiment:

31 Referring firstly to Figures 1 to 3 of the drawings,  
32 the carton erecting, loading and closing machine will be  
33 seen to comprise a carton erecting mechanism 1, a carton  
34 loading mechanism 2 for loading products into a carton C, a  
35 trailing end flap closing mechanism 3 and a bottom side flap  
36 and top flap closing mechanism 4 of known construction which  
37 does not form part of the present invention.

38 Since the carton erecting mechanism 1 is not essential



1 to the present invention, the loading and trailing end flap  
2 folding mechanisms 2 and 3 will now be further described.  
3 As will be noted from Figures 1 to 3, the carton C which  
4 has been erected by the mechanism 1 is indexed to a first  
5 predetermined position, or loading position, L with the side  
6 flaps S of the carton C extending perpendicularly from the  
7 sides of the carton C and the end flaps E extending  
8 downwardly as shown in Figure 3. The side flaps S are moved  
9 to the position shown in Figure 2 by a known "plough"  
10 arrangement P<sub>1</sub> commonly used in the industry which causes  
11 movement of the flaps as the carton C is transferred from  
12 the intermediate position A (Fig. 2) which may be a "park"  
13 position if desired by the erecting mechanism 1 to the  
14 loading position L. Similarly, the mechanism for achieving  
15 indexing movement of the carton is not shown in detail and  
16 may again take any suitable form known in the industry, such  
17 as the chain and dog mechanism W shown schematically in  
18 Figures 2 and 3 of the drawings, or any other suitable form  
19 of mechanism, such as a flight bar system.

20 The loading mechanism 2 comprises a product elevator 5  
21 comprising a platform 6 supported by brackets 7 carried by  
22 vertical guide rails 8 for vertical reciprocal movement by  
23 any suitable mechanical means B. The elevator 5 is shown in  
24 its elevated position in solid outline and in its lowered  
25 position in broken outline. The product P is loaded onto  
26 the platform in predetermined arrays adapted to fill the  
27 carton C by a known collating mechanism D.

28 It will be appreciated from the above description that  
29 a carton C is delivered by the erecting mechanism 1 to the  
30 loading position L and is positively held in that position  
31 by indexing lugs 9 and 10 on an indexing conveyor (not  
32 shown), as shown schematically in Figures 2 and 2 of the  
33 drawings. The product array P is then elevated vertically  
34 by the elevator 5 and enters the carton C through the open  
35 bottom flaps S and E. While the platform 6 remains in its  
36 elevated position, the carton and enclosed product array P  
37 is indexed forwardly onto the end flap closing mechanism 3,  
38 during which operation the leading end flap E<sub>1</sub> engages a

1 flap closing cam or bridging plate 11 adjacent the side of  
2 the mechanism 3 whereby the flap  $E_1$  is positioned under the  
3 product array P. During the same movement, the trailing end  
4 flap  $E_t$  is cammed by the plate 11 and the surface of the  
5 platform 6 to a perpendicular trailing position as shown in  
6 Figures 2 and 3 of the drawings. The side flaps S remain in  
7 the same position.

8 The trailing end flap closing mechanism 3 will be seen  
9 to comprise a shuttle platform 12, which is shown in greater  
10 detail in Figures 4 to 7 of the drawings, having a generally  
11 planar upper surface 14 in which a shaped slot 15 is formed.  
12 The slot 15 has an entry portion 16, a transfer portion 17  
13 and an exit portion 18 through which the trailing flap  $E_t$  is  
14 adapted to pass. The entry portion 16 has an upwardly  
15 directed lip 19 which is adapted to capture the trailing end  
16 flap  $E_t$  while the exit portion 18 has a downwardly directed  
17 lip 20 which ensures that the then folded flap  $E_t$  exits  
18 smoothly onto the top surface 14 of the shuttle 12. A  
19 shaped camming rod or "plough" 21 extends across the shuttle  
20 12 under the surface 14 intersecting the slot portion 17 and  
21 18 in the manner shown most clearly in Figure 4 of the  
22 drawings. The camming rod 21 operates to turn the trailing  
23 end flap  $E_t$ , from the position, as shown in Figure 5,  
24 through just over  $180^\circ$  to its closed position under the  
25 product array P.

26 The shuttle 12 is supported for its transverse movement  
27 on linear bearings 22, 23 and is reciprocated by any  
28 suitable mechanism, such as a chain drive mechanism or a  
29 pneumatic cylinder (not shown).

30 The manner in which the shuttle 12 operates to inwardly  
31 fold the trailing end flap  $E_t$  will be more clearly  
32 understood from a consideration of Figures 4 to 7 of the  
33 drawings, which show the several stages in the flap folding  
34 movement of the shuttle 12. In Figure 4, the carton C  
35 containing product P (not shown in Fig. 4(a) or (c)) has  
36 been indexed forwardly to a position where the leading end  
37 flap  $E_1$  has been folded under the product by the cam 11 (not  
38 shown in Figs. 4 to 7), and the product is partly supported

1 by the support track of the machine and partly by the upper  
2 surface 14 to the shuttle 12. In this position, the trailing  
3 end flap  $E_t$  is aligned with the entry portion 16 of the slot  
4 15, with the upwardly directed lip 19 positioned to engage  
5 the upper surface of the end flap  $E_t$  as the shuttle is moved  
6 transversely past the position of the carton C. As the flap  
7  $E_t$  enters the transfer portion 17, the flap  $E_t$  assumes the  
8 position shown in Fig. 5(b) and one of its side edges is  
9 engaged by the rod 21 and the flap  $E_t$  is turned by the rod  
10 21, as the shuttle 12 continues its transverse movement, to  
11 the position shown in Fig. 6 of the drawings. Further  
12 transverse movement of the shuttle 12 causes the flap  $E_t$  to  
13 be engaged by the downwardly directed lip 20 which completes  
14 the flap turning operation as the flap  $E_t$  leaves the slot 15  
15 through the exit portion 18, at which point it is fully  
16 folded under the product P, as shown in Fig. 7 of the  
17 drawings. It will be appreciated that the trailing end flap  
18 closing operation described above takes place during an  
19 otherwise "dead time" of the machine and is achieved without  
20 any forward or reverse movement of the carton C. In this  
21 way, the overall length of the machine may be significantly  
22 reduced compared with prior art loading and flap closing  
23 machines.

24 Following the trailing flap folding operation, the  
25 carton C is indexed forwardly under the flap folding  
26 mechanism 4 which folds the top and bottom side flaps S in a  
27 known manner which does not require further description. It  
28 will be seen from Figure 3 of the drawings that the top end  
29 flaps of the carton C may be folded to the closed position  
30 as the carton C is located in the loading position L  
31 although they may also be closed at the next indexing  
32 station.

33 Referring now to Figures 1, 2 and 11 of the drawings,  
34 the preferred carton erecting mechanism 1 will now be  
35 briefly described. The mechanism will be seen to comprise a  
36 supporting frame 25 having a magazine 26 for supporting a  
37 stack of carton C on their edges with the side panels and  
38 end and side flaps disposed in a substantially vertical

1 plane adjacent the end of the support frame 25. The  
2 magazine 26 has an adjustable fitting 27 having a downwardly  
3 projecting pin 28 which engages the upper edges of the  
4 cartons and serves to "break" each carton slightly open as  
5 it is withdrawn from the stack. A carton  
6 transporting/opening device 29 includes a support plate 30  
7 carrying a pair of vertically arranged suction cups 31, and  
8 an outwardly extending arm 40 fixed to one vertical edge of  
9 the plate 30 by hinge means 41 and carrying a suction cup 42  
10 in a slot 43 in the arm 40 in a manner which allows pivotal  
11 movement of the arm 40 with respect to the plate 30 while  
12 the suction cup 42 adheres to one side wall of the carton C.  
13 The arm 40 is spring biased, by means not shown, to adopt  
14 the rest position shown in Figure 2 of the drawings  
15 immediately a carton C is released from the magazine 26. A  
16 pneumatic ram 44 is connected between the plate 30 and the  
17 arm 40 and is operated as the carton moves from the magazine  
18 26 to the intermediate position A to positively move the  
19 side wall to which the suction cup 42 is attached towards  
20 the open position. This serves to resist any likelihood of  
21 the crease line  $C_1$  buckling inwardly to inhibit proper  
22 opening of the carton C.

23 To facilitate rotational and translatory movement of  
24 the carton C, the plate 30 is mounted on a vertical post 32  
25 which is movable longitudinally of the frame 25 from the  
26 pickup position adjacent the magazine 26 to the intermediate  
27 or "park" position A ready for indexing into the loading  
28 position L. The mechanism by which the rotary and  
29 longitudinal movement of the lifting mechanism 29 is  
30 achieved is not important to the invention and is therefore  
31 not shown in the drawings. It may comprise a combination of  
32 cam tracks and chain drives designed to achieve the  
33 necessary motions.

34 The transporting/opening mechanism 1 further comprises  
35 a fixed rail 33 (Fig. 2) positioned to one side of the  
36 desired intermediate or "park" position A for the carton C.  
37 The fixed rail 33 is adapted to be engaged by the carton C  
38 as it is moved towards the intermediate position to

1 facilitate the final erection of the carton as shown in Fig.  
2 2. It will be appreciated from the above that the suction  
3 cups 31 and 42 will be attached to a source of suction (not  
4 shown) to facilitate the positive gripping of each carton C  
5 by the mechanism 29.

6 The transporting/opening mechanism 29 is positioned so  
7 that each carton C is engaged by the suction cups 30 on its  
8 exposed end wall and by the suction cup 42 on the exposed  
9 side wall. As the carton is initially withdrawn from the  
10 magazine 26, the pin 28 momentarily anchors the trailing  
11 panels of the carton C thereby "breaking" open slightly the  
12 carton C as it is withdrawn from the magazine 26. The  
13 mechanism 29 then moves from the pickup position adjacent  
14 the magazine 26 to the "park" position A shown in Figure 2  
15 at the same time rotating through approximately 180°. This  
16 movement, as well as actuation of the ram 44, serves to  
17 further open the carton and as the leading corner of the  
18 carton engages the fixed rail 33 and the lifting mechanism  
19 29 continues to rotate and move towards the "park" position  
20 A, the carton C will be fully opened with the side flaps S  
21 and the end flaps E directed upwardly and downwardly as  
22 shown in Figure 2.

23 It will be appreciated that since the carton C is  
24 rotated as described above, the lifting mechanism 29 is  
25 disposed in the "park" position A to the rear of the carton  
26 C so that the mechanism 29 may be withdrawn to its pickup  
27 position without in any way inhibiting the continued forward  
28 movement of the carton C. Thus, the mechanism may return to  
29 pick up a further carton C as the preceding carton C is  
30 loaded in the manner described above thereby improving the  
31 efficiency of operation of the combination of the  
32 transporting/erecting mechanism 29 and the loading and  
33 closing mechanism.

34 As mentioned above, the transporting/opening mechanism  
35 29 may be replaced by another mechanism although a mechanism  
36 in which the transporting mechanism is finally disposed at  
37 the rearmost panel of the carton is to be preferred for the  
38 reasons outlined above. Similarly, the trailing end flap

1 closing mechanism 3 may be replaced by any other suitable  
2 mechanism which performs a similar function. For example,  
3 one shortcoming of the shuttle mechanism 12 described above  
4 is that it is somewhat longer than may be desired where the  
5 space in which the machine must operate is somewhat limited.  
6 In such a situation, the shuttle mechanism 12 may be  
7 significantly shortened and its operation modified so that  
8 movement in one direction causes the trailing flap  $E_t$  to  
9 enter the entry portion of the slot 15 whereupon a cam or  
10 arm pushes the flap slightly towards its closing direction  
11 whereupon the shuttle is moved in the opposite direction  
12 whereby a cam rod or plough similar to item 21 engages the  
13 flap to push it fully to its closed position. While some  
14 reversal of direction is required in this modification, the  
15 time taken to close the flap  $E_t$  should not be significantly  
16 greater than the time taken to perform the same operation in  
17 the previous embodiment.

18 A modified form of shuttle mechanism 12' is shown in  
19 Figures 8 and 9 of the drawings. In this arrangement, the  
20 upper surface 14' of the shuttle is formed with a somewhat  
21 similarly shaped slot 15' having an entry portion 16', a  
22 transfer portion 17' and an exit portion 18' through which  
23 the trailing flap  $E_t$  is adapted to pass. In this embodiment  
24 however, the entry portion 16' does not have an upwardly  
25 directed lip as in the previous embodiment, but rather has a  
26 shaped flap 19a hinged to the upper surface 14' at 19b and  
27 having a downwardly depending cam 19c (Fig. 9) which is  
28 adapted to be engaged by a cam following 19d fixed to the  
29 rod 19e of an air cylinder 19f, by means of which the flap  
30 19a may be elevated to the position shown in Fig. 9 from the  
31 flat or planar position shown in Fig. 8 in which an  
32 essentially planar surface is presented. The shuttle is also  
33 provided with a camming rod 21' and the exit portion 18' has  
34 a downwardly directed to surface 20' by means of which the  
35 trailing flap  $E_t$  of the carton C is folded in the manner  
36 described in the previous embodiment.

37 The advantage provided by the above alternative shuttle  
38 12' is that the flap 19a may be elevated by means of a timed

1 valve operation to open the entry portion 16' to receive the  
2 flap  $E_t$  as the shuttle moves transversely under the carton  
3 C. When the shuttle reaches the position similar to that  
4 shown in Fig. 7 of the drawings, the flap 19a may be lowered  
5 and the shuttle 12' return to its rest position as the next  
6 carton C is moved into a position similar to that shown in  
7 Fig. 4 of the drawings. In this way, time is saved and the  
8 operation may be accelerated accordingly. It will be  
9 appreciated that the upwardly directed lip 19 of the  
10 previous embodiment prevents this time saving being  
11 achieved.

12 In the alternative form shown in Figure 10 of the  
13 drawings, the width of the shuttle 12'' is effectively  
14 halved and a removable support 19'' is secured to one edge  
15 to provide support for the carton C in the position  
16 corresponding substantially to that shown in Figure 4 of the  
17 drawings. The length of the portion 19'' corresponds to the  
18 width of the carton C, and the portion 19'' is removable so  
19 that cartons of different sizes may be accommodated without  
20 replacing the shuttle completely. The portion 19'' defines  
21 an edge 16'' past which the trailing end flap  $E_t$  is allowed  
22 to move as the shuttle 12'' moves transversely under the  
23 carton C. The longitudinal edge 15'' corresponds to the slot  
24 15 and guides the flap  $E_t$  towards a shaped camming plate 21'  
25 which curves inwardly and upwardly towards the trailing edge  
26 of a slot 18'' in the upper surface 14'' of the shuttle  
27 12''. The plate 21'' performs the same function as the  
28 camming rod 21 in the previous embodiment. In the present  
29 embodiment, the plate 21'' may be cast from aluminium or  
30 moulded from some suitably rigid plastics material. It will  
31 be appreciated that as the shuttle 12'' moves under the  
32 carton C, the trailing flap  $E_t$  drops past the edge 16'' and  
33 assumes the position adjacent the longitudinal edge 15''  
34 until it is engaged by the camming plate 21 which turns the  
35 flap  $E_t$  towards the closing position whereupon it exits from  
36 the slot 18'' and rests on the upper surface 14'' of the  
37 shuttle 12''. It will also be appreciated that a camming  
38 plate similar to 21'' may be used in the previous described

1   embodiments. In this modified arrangement, the removable  
2   support 19, not only supports the carton, but also performs  
3   the camming function performed by bridging plate 11 in the  
4   first embodiment. Thus, the width of the cam and shuttle  
5   portion of the machine is reduced, thereby allowing an  
6   overall reduction in the length of the machine.

7       As mentioned briefly at the beginning of this  
8   specification, the arrangements described above also have  
9   the advantage of requiring less adjustment to accommodate  
10   cartons of different sizes than machines according to the  
11   prior art. This results primarily from the use of the fixed  
12   rail 33 and the indexing of the cartons to positions  
13   dictated by the rearmost face of the carton in each  
14   operative position. By indexing at the rear face, the  
15   length of the carton is not important and only minimal  
16   adjustment is required to compensate for different widths.  
17   In this regard the shuttle 12 is designed to accommodate end  
18   flap widths of all dimensions, the entry portion 20 of the  
19   slot 15 being wide enough for this purpose. This also  
20   results in the mechanism for collating the products for  
21   delivery to the platform 6 being easier to adjust for  
22   changes in carton dimension.



## 1 CLAIMS:

2 1. A carton loading and closing machine comprising means  
3 (1) for locating an open carton (C) in a first predetermined  
4 position (L), means (2) for loading said carton through the  
5 open bottom flaps of said carton (C) at said first  
6 predetermined position (L), means (W) for moving said carton  
7 forwardly to a second predetermined position over means (11)  
8 for folding the leading end flap ( $E_l$ ) of said carton to the  
9 closed position under said packaged products (P), second  
10 flap folding means (3,12) mounted for movement transversely  
11 of said carton at said second predetermined position to fold  
12 said trailing end flap ( $E_t$ ) against said packaged products  
13 (P), said second flap folding (3,12) means including an  
14 upper surface (14) defining an opening (15) for receiving  
15 said trailing flap ( $E_t$ ) and means (20,21) for causing said  
16 trailing flap to be folded to the closed position as said  
17 second flap folding means (12) is moved transversely with  
18 respect to said carton (C).

19 2. The machine of claim 1, wherein said second flap  
20 folding means (3) comprises a reciprocating shuttle means  
21 (12) including said upper surface (14) defining said opening  
22 (15) for receiving said trailing flap ( $E_t$ ), said opening  
23 (15) including a first portion (16) extending generally  
24 transversely of the direction of movement of said shuttle  
25 means (12), a second portion (17) extending longitudinally  
26 of the direction of movement of the shuttle means (12), and  
27 a third portion (18) extending transversely of the direction  
28 of movement of the shuttle means (12) in a direction  
29 opposite to said first portion (16), said first portion (16)  
30 being positioned to enable said trailing end flap to  
31 penetrate said upper surface (14), said second portion (17)  
32 being positioned to enable relative movement between said  
33 shuttle means (12) and said carton (C), and said third  
34 portion being positioned to enable said trailing flap ( $E_t$ )  
35 to engage said upper surface (14) in its folded condition,  
36 said means for causing said trailing flap to be folded  
37 including means (21) for engaging said trailing flap while  
38 associated with said second portion (17) and for partly

1 turning said flap towards the closed position and means (20)  
2 associated with said third portion (18) for completing the  
3 folding of said flap as said shuttle means moves relative to  
4 said flap to allow said flap to pass through said third  
5 portion (18).

6 3. The machine of claim 2, wherein said opening (15) is in  
7 the form of a narrow slot having said first, second and  
8 third portions (16,17,18), said upper surface (14) being  
9 formed with an upwardly extending lip (19) along the  
10 trailing edge of said first portion (16) of said slot (15),  
11 and a downwardly extending lip (20) associated with the  
12 trailing edge of said third portion (18) of said slot (15).

13 4. The machine of claim 2 or 3, wherein said means for  
14 causing said trailing flap to be folded includes a camming  
15 rod (21) extending generally diagonally to the direction of  
16 travel of said shuttle means (12) and intersecting said  
17 second portion (17) and said third portion (18) of said  
18 opening or slot (15).

19 5. The machine of claim 3, wherein said first portion of  
20 said slot is defined by a pivoted plate (19a) capable of  
21 being elevated from a position in which it is generally co-  
22 planar with said upper surface (14) to an elevated position  
23 in which the trailing edge of said first portion (19') of  
24 said slot (15') is upwardly inclined to receive the trailing  
25 end flap ( $E_t$ ).

26 6. The machine of claim 2, wherein said opening is a  
27 generally rectangular opening formed in one edge of said  
28 shuttle means (12'') to define said first and second  
29 portions (16'',17''), said third portion (18'') comprising a  
30 slot (18'') formed in said upper surface (14'') and opening  
31 to said second portion (17''), and a camming surface (21'')  
32 extending from said slot (18'') and laterally of said second  
33 portion (17'') to cause folding of said trailing end flap  
34 ( $E_t$ ) to the closed position.

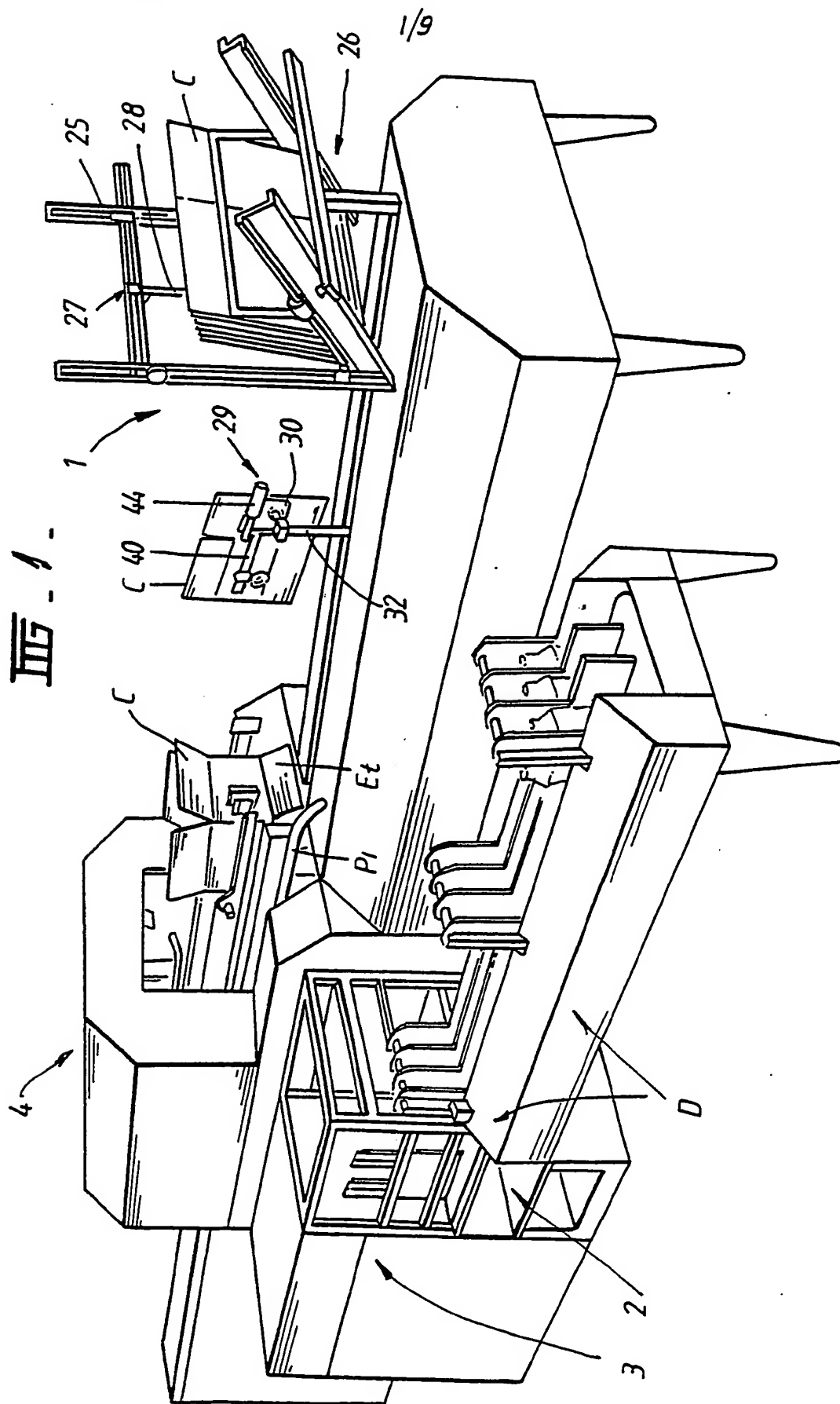
35 7. A carton loading and closing machine, comprising means  
36 (30,31) for removing a collapsed carton from a stack and  
37 arranged to contact at least one end wall of the carton,  
38 means (29) for unfolding the carton into a generally

1 rectangular state and for locating said unfolded carton in a  
2 first predetermined position (A), said unfolding and  
3 locating means including a rail (33) against which said  
4 unfolding means causes said carton to be engaged with one  
5 side wall of said carton being located against or adjacent  
6 to said rail, said means (30,31) for removing said carton  
7 being adapted to turn through about 180° so that when the  
8 unfolded carton is located in said predetermined position  
9 (A), said removing means is located adjacent the rear most  
10 end wall of the carton, means for moving said carton to a  
11 second predetermined position (L) with the bottom side flaps  
12 of the carton extending outwardly from the sides, means (2)  
13 for loading said carton through the open bottom flaps of  
14 said carton at said second predetermined position (L), means  
15 (W) for moving said loaded carton to a third predetermined  
16 position and for folding one of the end flaps (E<sub>1</sub>) at the  
17 bottom of the carton to its closed position, means (3,12)  
18 for folding the other end flap at the bottom of the carton  
19 to its closed position while the carton is held stationary  
20 at said third predetermined position, said first, second and  
21 third predetermined positions being defined by the rear end  
22 wall of the carton whereby the size of carton being loaded  
23 and closed by said machine may be altered to accommodate a  
24 wide range of different carton sizes without structural  
25 alteration of the machine.

26 8. The machine of claim 7, wherein said second flap  
27 folding means is as defined in any one of claims 1 to 6.

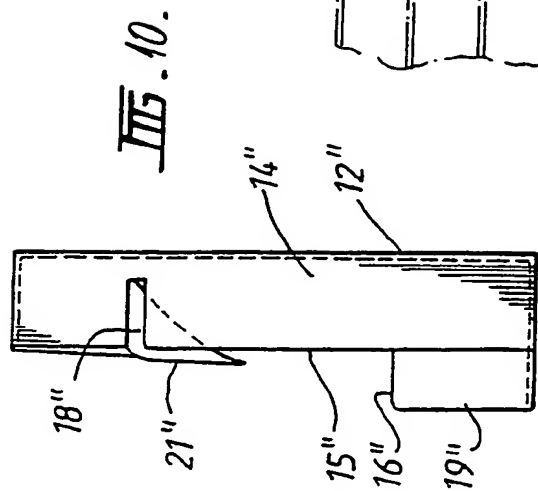
28 9. A carton transporting and opening mechanism (1),  
29 comprising means (26) for holding a multiplicity of folded  
30 cartons (C), means (29) for lifting one of said cartons (C)  
31 from said multiplicity by at least one end panel of said  
32 carton, means for moving the carton from its initial  
33 position through an intermediate position (A) to a first  
34 predetermined position (L) and for rotating said carton  
35 through about 180° during said movement whereby the lifting  
36 means is located at the rear most end panel of said carton  
37 (C), and fixed rail means (33) located to one side of said  
38 intermediate position (A) and against which a leading corner

1 of said carton engages whereby part of said rotary movement  
2 of said carton causes the carton to be fully opened when  
3 located at said first predetermined position (L).  
4 10. The mechanism of claim 9, wherein said lifting means  
5 further includes a hinged arm (40) extending laterally from  
6 said lifting means (29) and carrying means (42) for engaging  
7 the adjacent side wall of said carton, said arm (40) having  
8 means (44) for rotating said arm in a direction tending to  
9 open the carton as said lifting means lifts a carton from  
10 said multiplicity.  
11 11. The mechanism of claim 10, wherein said movement of  
12 said arm is achieved by spring biasing means, said arm  
13 further including means (44) for positively pivoting said  
14 arm (40) in the carton opening direction as said carton is  
15 transported towards said first predetermined position (A).  
16 12. The machine of any one of claim 1 to 8 further  
17 including the carton opening mechanism defined in any one  
18 claims 9 to 11.  
19 13. A method of loading and closing a carton comprising the  
20 steps of locating an open carton in a first predetermined  
21 position (L) with the lowermost flaps of said carton open,  
22 loading the products to be packaged into said carton through  
23 said open bottom flaps at said first predetermined position  
24 (L), moving said carton (C) forwardly to a second  
25 predetermined position and folding the leading end flap of  
26 said carton to its closed position under the packaged  
27 products during said forward movement, and closing the  
28 trailing end flap of said carton to its closed position  
29 under said packaged products while said carton is held  
30 stationary at said second predetermined position.

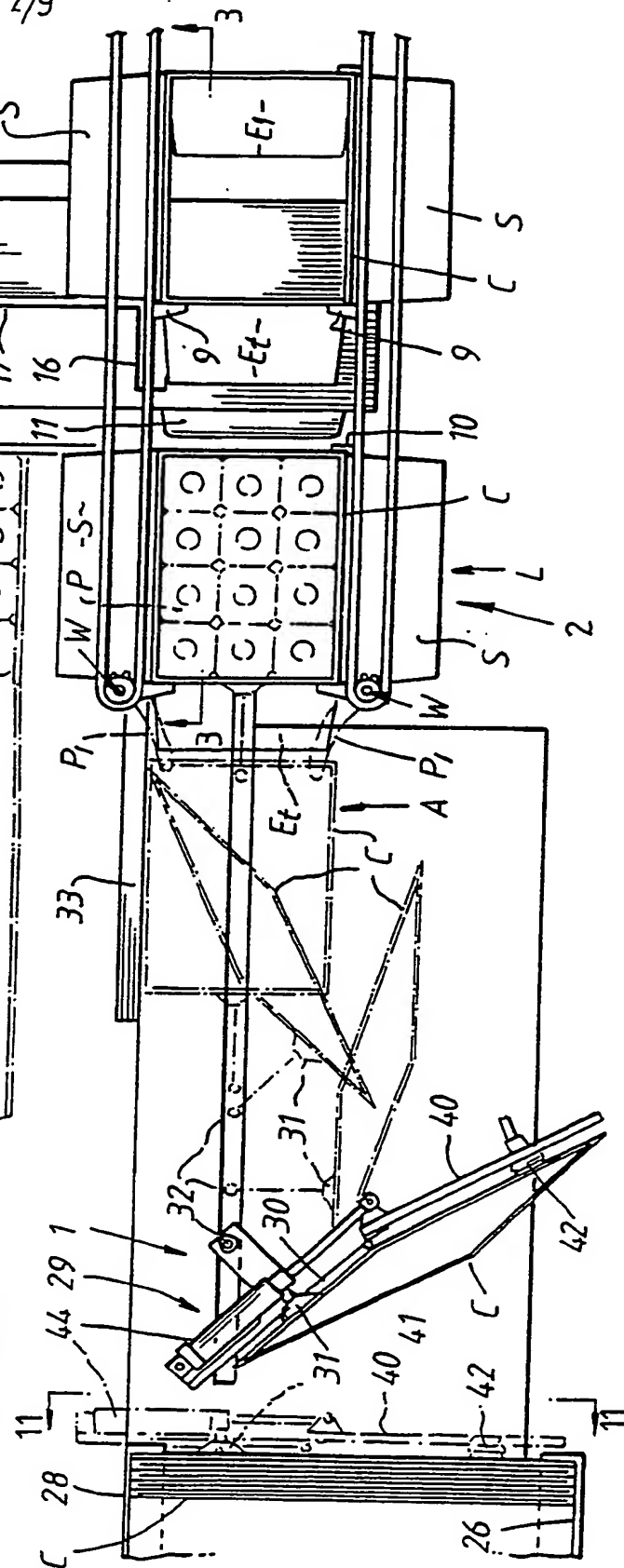
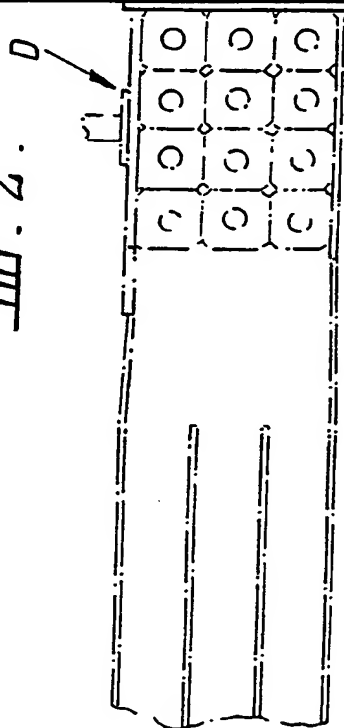


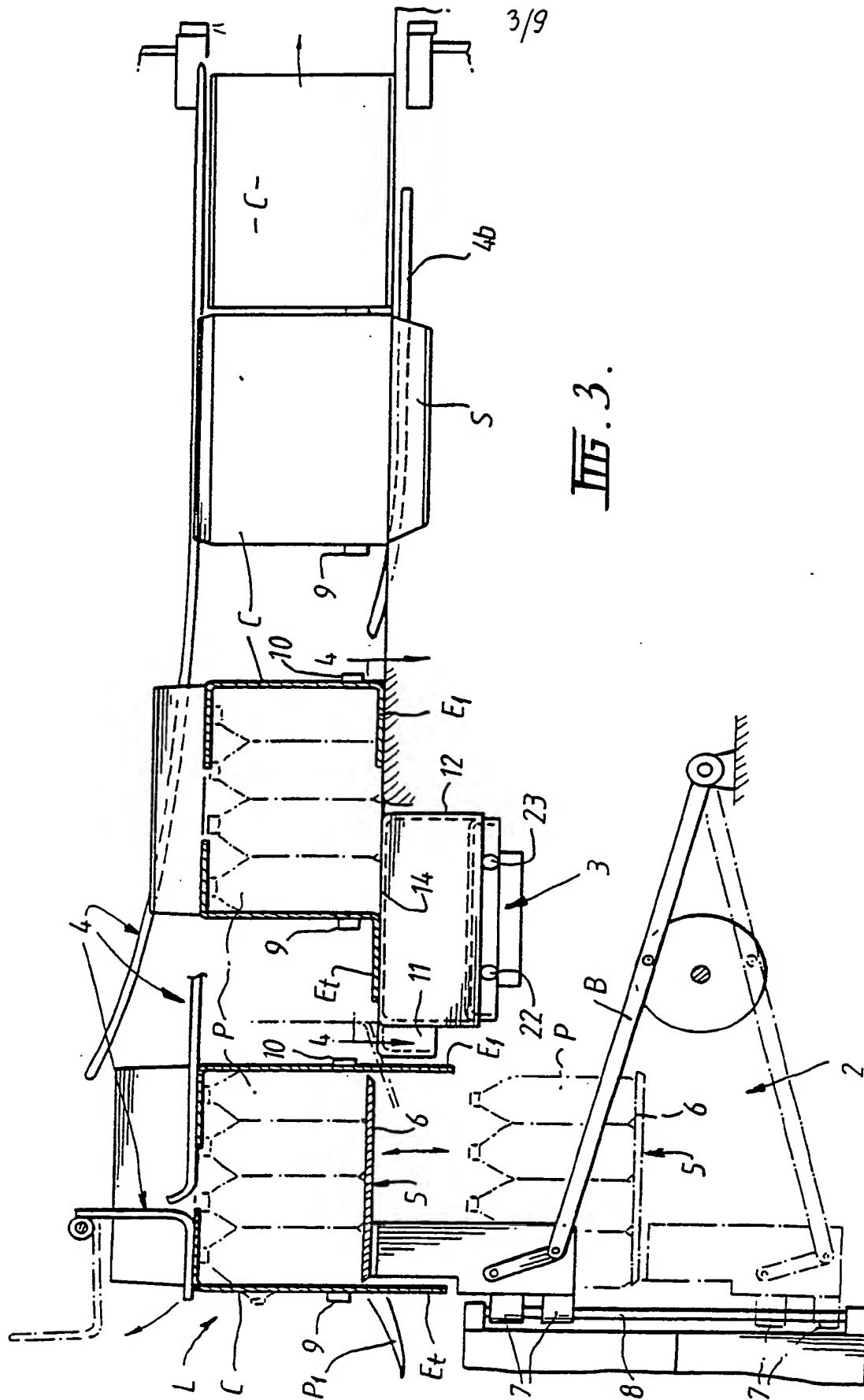
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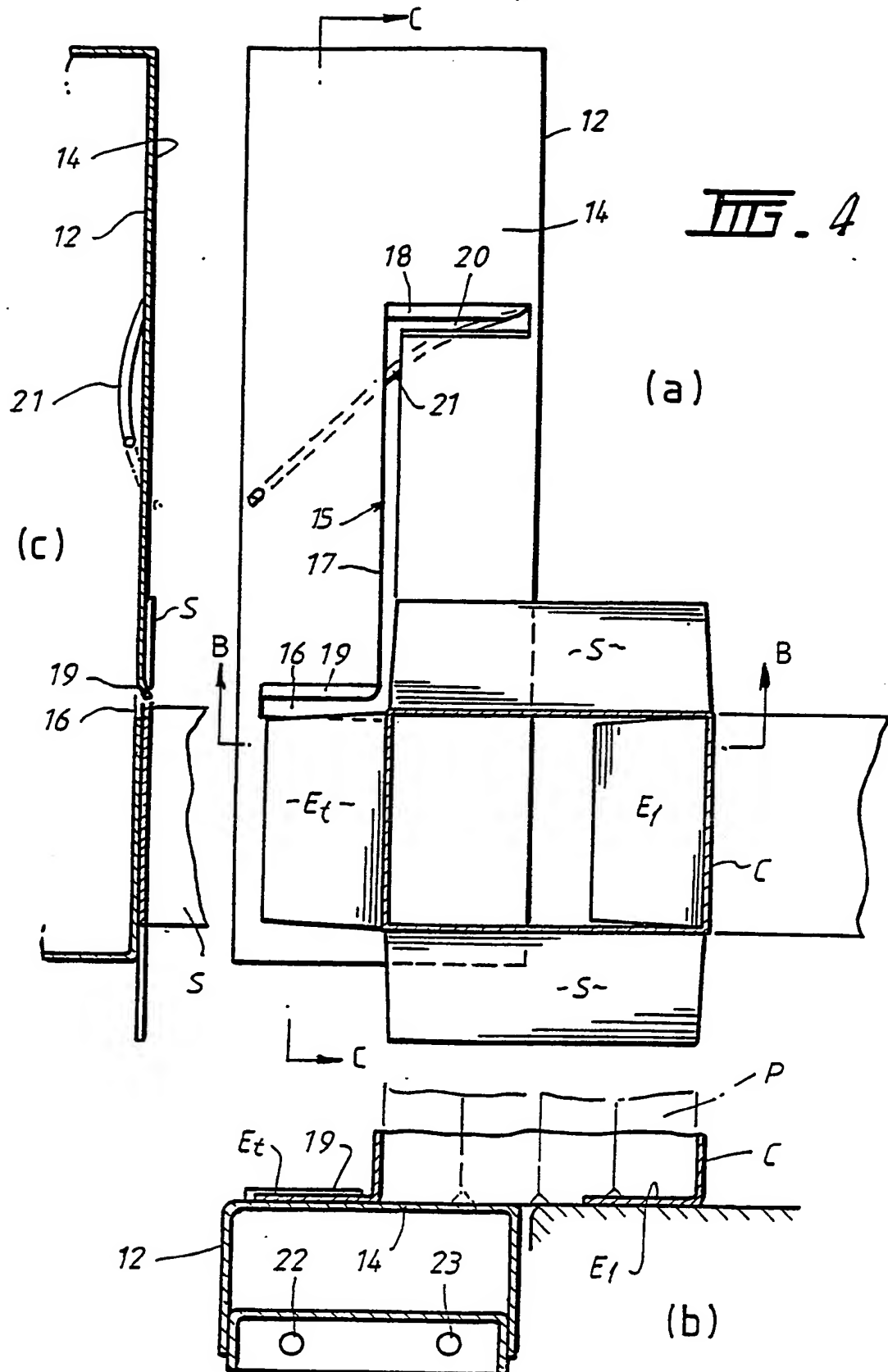
**FIG. 2.**





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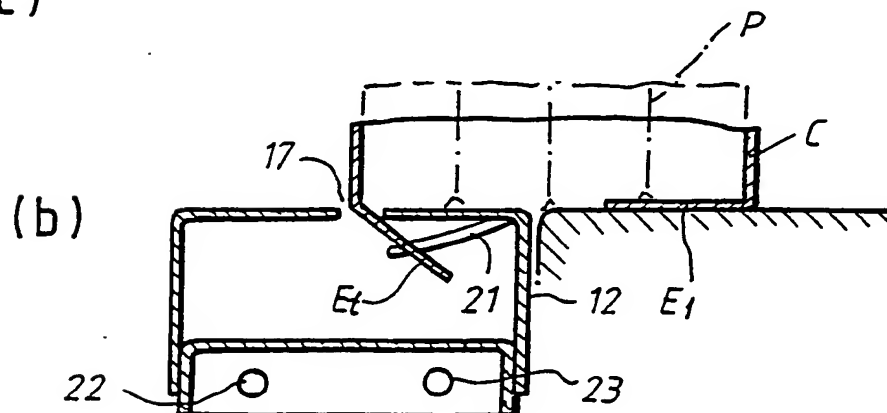
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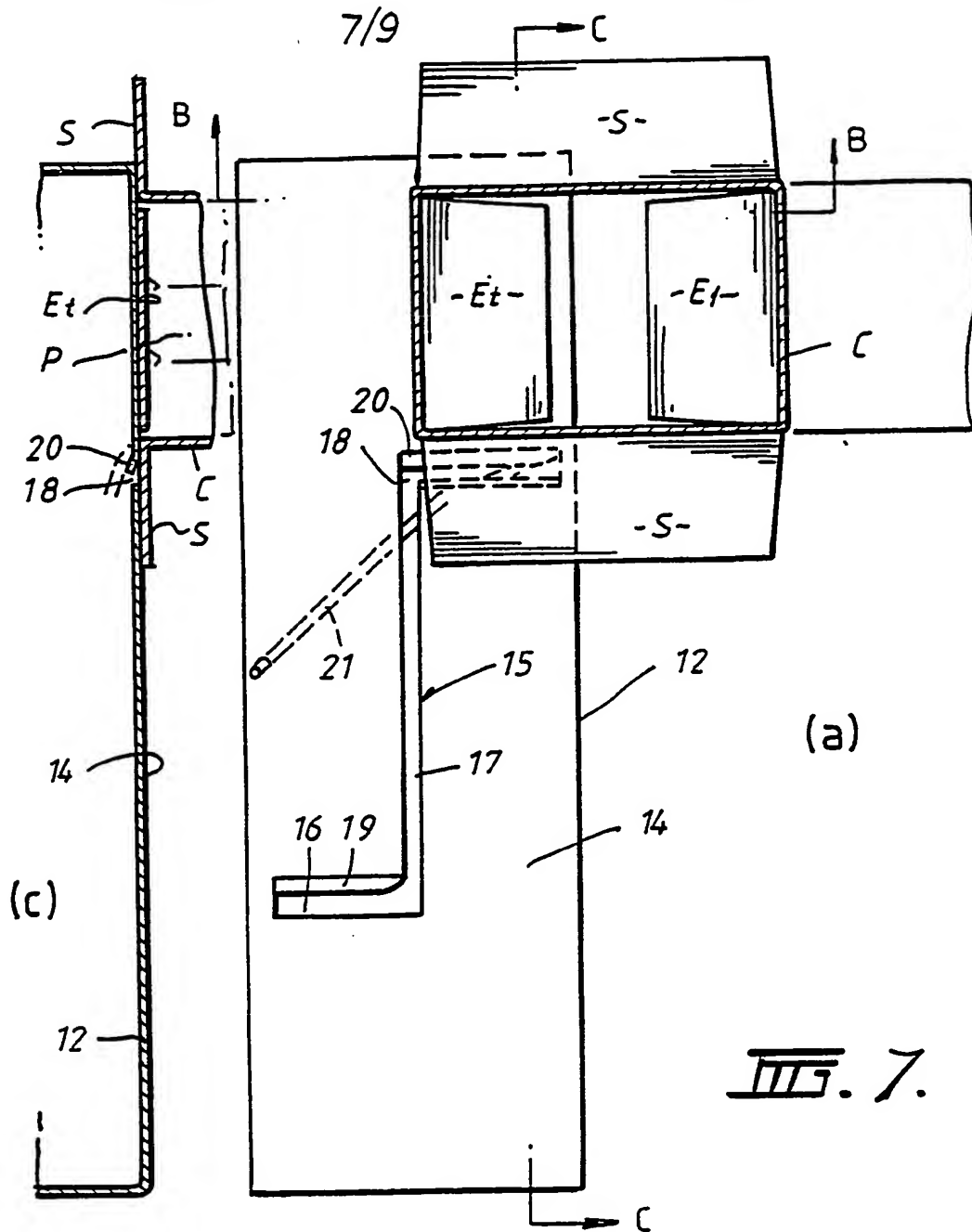




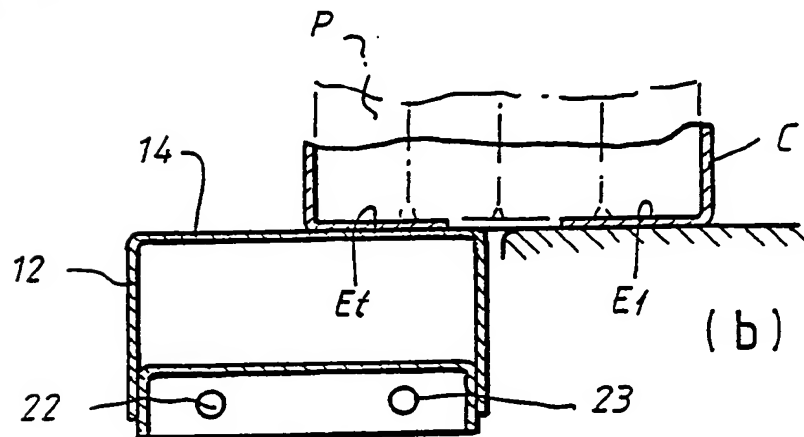


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III. 7.



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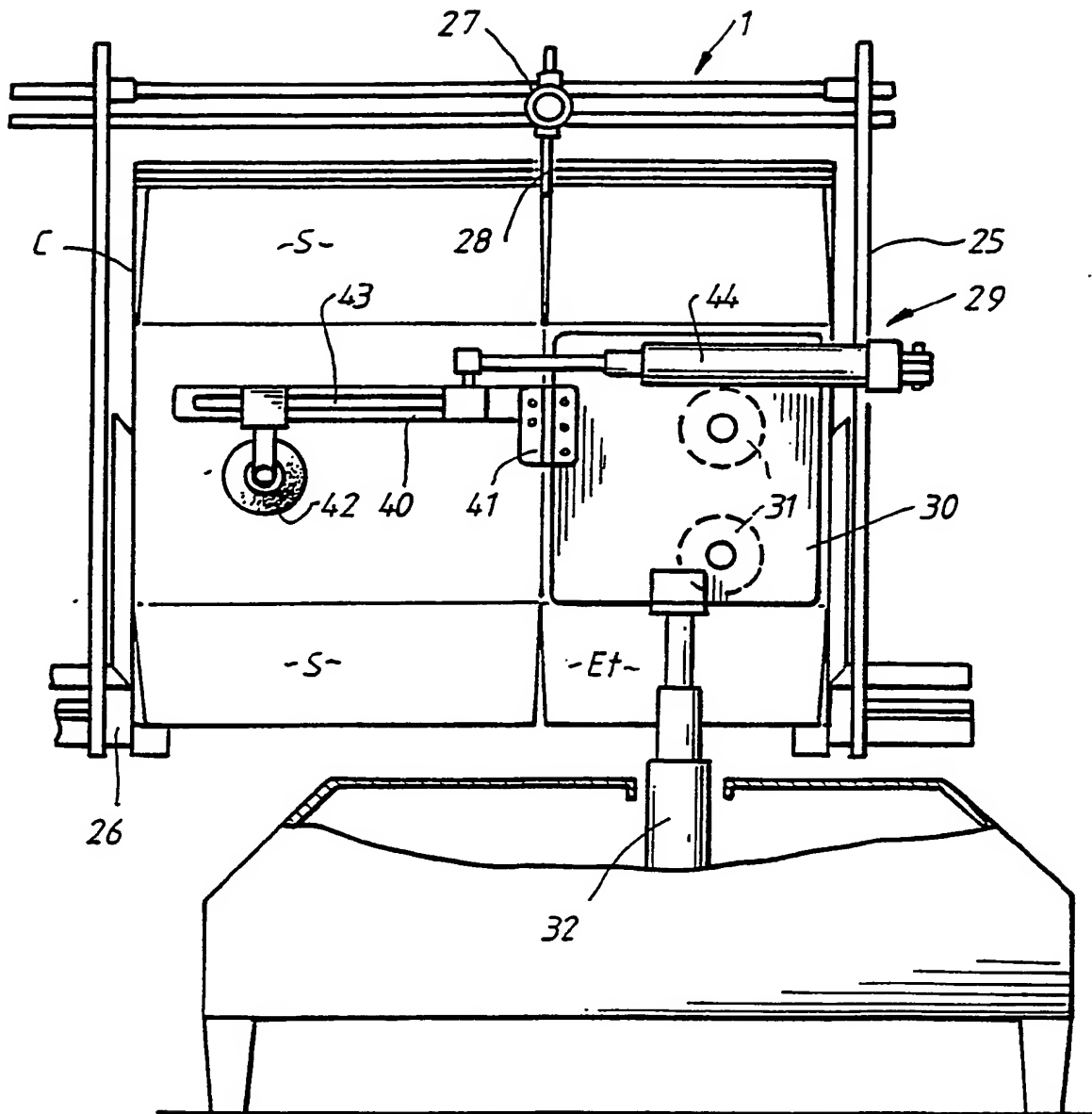


FIG. 11.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 88/00249

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> : 1. Inventive Classification symbol is applied. Indicate this. According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; margin-top: 10px;">             Int. Cl.<sup>4</sup>      B65B 7/20, 5/02         </div>						
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; margin-top: 10px;">             Minimum Documentation Searched *         </div> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; text-align: center; padding-top: 10px;">IPC</td> <td style="border: none; text-align: center; padding-top: 10px;">B65B 7/20, 5/02</td> </tr> </table> <div style="text-align: center; margin-top: 10px;">             Documentation Searched other than Minimum Documentation              to the extent that such documents are included in the fields searched *         </div> <div style="text-align: center; margin-top: 20px;">             AU : IPC as above         </div>			Classification System	Classification Symbols	IPC	B65B 7/20, 5/02
Classification System	Classification Symbols					
IPC	B65B 7/20, 5/02					
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> *						
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages **	Relevant to Claim No. **				
A	DT,A, 2617080 (NORDISHER) 20 October 1977 (20.10.77).	(1-6,13)				
A	US,A, 3442062 (LENSE) 6 May 1969 (06.05.69)	(1-6,13).				
A	US,A, 4317320 (NIGRELLI) 2 March 1982 (02.03.82)	(1-6,13)				
A	FR,A, 1040542 (LEVER BROTHERS) 15 October 1953 (15.10.53)	(9-12)				
A	DE,A, 3417508 (KNUTH) 14 November 1985 (14.11.85)	(9-12)				
A	US,A, 3673764 (BELL et al) 4 July 1972 (04.07.72)	(1-6,13)				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special Categories of cited documents: **</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>						
<b>IV. CERTIFICATION</b>						
Date of the Actual Completion of the International Search 16 September 1988 (16.09.88)		Date of Mailing of this International Search Report 21 OCTOBER 1988 (21.10.88)				
International Searching Authority Australian Patent Office		Signature of Authorized Officer <div style="text-align: right;">                       P. WARD                 </div>				